Roll No. | | | | | | | | | | | | | **Total No. of Pages : 02**

Total No. of Questions : 08

B.Tech. (CHS) (2018 & Onwards) (Sem.–1)

MATHEMATICS-I

Subject Code : BTAM-106-18

M.Code : 75368

Time : 2 Hrs. **Max. Marks : 30**

INSTRUCTIONS TO CANDIDATES :

1. **Attempt any FIVE question(s), each question carries 6 marks.**

1. Using Gauss Jordan method find the inverse of matrix $\begin{bmatrix} 1 & 1 & 3 \\ 1 & 3 & -3 \\ -2 & -4 & -4 \end{bmatrix}$

2. a) Solve by Cramer's rule $x - 3y + z = 2$

$$3x + y + z = 6$$

$$5x + y + 3z = 3$$

b) For the matrix $A = \begin{bmatrix} 3 & -3 & 4 \\ 2 & -3 & 4 \\ 0 & -1 & 1 \end{bmatrix}$, show that $A^3 = A^{-1}$.

3. For the matrix $A = \begin{bmatrix} 1 & 0 & -1 \\ 1 & 2 & 1 \\ 2 & 2 & 3 \end{bmatrix}$, determine whether eigen vectors are orthogonal.

4. Express matrix $\begin{bmatrix} -1 & 7 & 1 \\ 2 & 3 & 4 \\ 5 & 0 & 5 \end{bmatrix}$ as a sum of symmetric and skew symmetric matrix.

5. Prove that :

a) $div V\left(\frac{\vec{r}}{r^3}\right) = 0$

b) $\nabla^2(r^n) = n(n+1)\, r^{(n-2)}$ where $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$

6. a) Find the directional derivative of $f = x^2 - y^2 + 2z^2$ at point P (1, 2, 3) in the direction of line PQ, where Q is (5, 0, 4).

   b) Find $div\,\vec{F}$ and $curl\,\vec{F}$ of $\vec{F}$ where $\vec{F}$ = grad $(x^3 + y^3 + z^3 - 3xyz)$

7. Evaluate $\int_S F.Nds$ where $F = 2x^2\,y\hat{i} - y^2\hat{j} + 4x^2 z\hat{k}$ and S is the closed surface of region in the first octant bounded by cylinder $y^2 + z^2 = 9$ and the planes $x = 0$, $x = 2$, $y = 0$ and $z = 0$.

8. a) Verify green's theorem for $\int_C [(y - \sin x)\,dx + \cos x\,dy]$ where C is the plane triangle enclosed by the lines $y = 0$, $x = \frac{\pi}{2}$, $y = \frac{2}{\pi}x$.

   b) Evaluate $\int_C \vec{F}, d\vec{r}$ where $\vec{F} = xy\hat{i} + yz\hat{j} + zx\hat{k}$ and curve C is $\vec{r} = t\hat{i} + t^2\hat{j} + t^3\hat{k}, t$ varies from -1 to 1.

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